Validity of PTSD diagnoses in VA administrative data: Comparison of VA administrative PTSD diagnoses to self-reported PTSD Checklist scores

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Abstract—Little research has been done on the validity of posttraumatic stress disorder (P TSD) diagnoses that are found in Department of Veterans Af fairs (VA) administra tive data, even though they are often used in VA research. We compared PTSD diagnoses found in VA administrative data with PTSD Checklist (PCL) scores self-reported by 4,777 newly diagnosed participants in a national postal survey study. Using PCL scores of at least 50 as th e go ld stan dard, we compared p ositive p redictive v alues (PPVs) for at least one versus at least two PTSD diagnoses (found within 4 months of the first) in VA administrative data overall and by su bgroups of in terest: ag e, sex, a nd clinic where first diag - nosed. The overall PPV was 75% for at least one PTSD diagnosis and 82% for at least two PTSD diagnoses. Similarly, the PPV sig- nificantly increa sed for all subgroup analyses when at least two PTSD diagnoses were used. The increase in PPV was greatest for those first diagnosed in primary care and for those older than 65. To select a sample of veterans with more definitive PTSD from administrative data, researchers should select those veterans with at least two PTSD diagnoses as opposed to at least one.

Key words: administrative data, algorithm, electronic medical record, new episode, PCL, PTSD, PTSD Checklist, PTSD diag- nosis, PPV, sample, sample inclusion criteria, validity, Veterans Health Administration.

INTRODUCTION

The Dep artment o f Veterans Af fairs (VA) has one of the largest repositories of electronically collected, adminis-

trative, national healthcare da ta. Researchers often use this administrative data to id entify patient po pulations for research studies. Intern ational Cl assification of Diseases- 9th Rev ision (ICD-9) d iagnosis codes are often used for this purpose. ICD-9 co des are entered into the local com- puterized patient reco rd system to indicate a problem treated at either an ou tpatient encounter or during an inpa - tient e pisode of ca re. Thes e data are co mpiled n ationally and made available to re searchers by the Austin Informa- tion Technology Cen ter. Using these codes from adminis - trative data of fers many advantages to researche rs, including cost-effectiveness and placing minimal or no bur- den on potential research participants.

Posttraumatic stress disord er (PTSD) is an important research focus within the VA. Researchers use ICD-9 codes from VA administrative data to identify populations of veterans with PTSD for inclusion in research studies. To date, little investigation has been done on the validity of PTSD diagnosis codes that are found in VA administrative data, despite the fact that they are often used for research purposes. The validity of these co des could be d iminished by data entry errors, diagno stic inaccuracy, or various other factors that lead to providers incorrect ly entering or not entering PTSD diagnoses into patients' records. Our overall goal is to add to the sparse, almost nonexistent, literature on the validity of P TSD diagnoses in V A administrative data. We will evaluat e the validity of two P TSD administrative data alg orithms by comparing them with self-reported PTSD Checklist (PCL) scores collected through a national survey. Additionally, we will look at the decrease in sample size th at resu lts from using the more restrict ive algorithm and the variations in validity and sample size by importan t subgroups of in terest: age, sex, and clin ic where first diagnosed with PTSD. This inform ation will aid researchers in identifying study samples in which a greater percentage of participants are li kely to actually have P TSD. In addition, researchers will have more information with which to make decisions about using ad ministrative data to select P TSD samples for research studies in that they will know with more acc uracy the actual compos ition of their sa mple. Ultimately, these contributions will lead to more accurate inferences from V A P TSD re search studie s tha t use administrative data to select samples, which could then lead to more effective interventions for PTSD. The investigation of the validity of PTSD diagnosis codes is essential to using these codes in VA research.

BACKGROUND

Many examples e xist of studie s in which re searchers use P TSD diagnoses from V A administrative data to obtain study samples. In one study, Mohamed and Rosenheck used P TSD diagno ses from VA administrative data to identify a population of patients with PTSD to examine prescription behavior [1]. As their sample inclusion criteria, they included all V A pa tients who had at least one PTSD diagnosis in administrative data in fiscal year 2004. Rosenheck and Fontana used PTSD diagnoses from VA administrative data from 180 days before and 180 days after September 11, 2001, to examine whether the use of mental health services changed during that time frame for

people diagnosed with PTSD [2]. They also used the criterion of finding at least one PTSD diagnosis in administrative records. These are just two examples.

Although several studies have u sed VA administrative data to select veteran samples with P TSD, to our knowl - edge, only two studies have examined the validity of PTSD diagnosis codes in administrative data. The first, by Magruder and Yeager, used a sample of VA primary care patients to compare ICD-9 codes in administrative data against diagnostic interview data fro m the Clinician-Administered P TSD Scale (CAPS) [3]. They found th at only 43 percen t of those di agnosed with PTSD based on the CAPS carried a P TSD ICD-9 code in their medical record within 2 years of CA PS administration, sugg esting that among primary care patients, PTSD would be under-identified on the basis of administrative data alone. Examination of subgroups revealed that providers were more apt to recognize P TSD and thus enter a PTSD diagnosis code into administra tive data for middle aged (potentia lly V ietnam) veterans. The second study, by Frayne et al., compared various administrative data al gorithms to sel f-reported life-time PTSD status in a national cohort of veterans with dia - betes [4]. The algorithms included using at least one versus at least two PTSD diagnoses codes in any VA record (outpatient or in patient) wit hin a 2-year period and comparing at least one diagnosis from mental health outpatient visits versus primary care outpatient visits versus any outpatient visit within that same 2-year period. They found that the positive predictive values (PPVs) were higher when using at least two instances of P TSD in either outpatie nt or inpatient administrative databases (9 0%) versus using at least one instance (8 2%). When only outpatient databases and only one instance of PTSD were used as the criteria, the PPV was higher for dia gnoses assoc iated with primary ca re visits (88%) than for mental health care visits (85%) or any ambu-latory care visit (82%).

This study is a secondary an alysis of data collected for a lar ge national survey study.[*] This large surve y study's main purpose was to identify factors associated with partici-pation in mental health treatment among veterans who were newly diagnosed with PTSD. A national sample of veterans with at least one PTSD diagnosis (ICD-9 code 309.81) dur-ing the recruitment period was id entified through VA

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administrative data. Veterans were excluded if they had severe cognitive impairments, received antidepressants, had any mental health care (except chemical dependency), or had any PTSD-related visits in the prior year. The sample was identified through VA administrative data, specifically through the outpatient encounter files from the National Patient Care Database (NPCD). These files are updated every 2 weeks and made available to researchers; therefore, new PTSD cases were identified every 2 weeks. For every new PTSD case that was identified, a mailed survey was administered immediately. Service utilization data and prescription data were then extracted for the following 6 months in order to study participation in mental health treatment. From this larger survey study of people with at least one new PTSD diagnosis, we used administrative data to look for a second PTSD diagnosis; we also took PCL scores from the mailed survey and various demographic variables from both the survey and administrative data. The large survey study was not fully complete at the time of publication of this article.

Studies published to date have not compared the use of PTSD ICD-9 diagnosis codes from VA administrative data against the PCL. Although the PCL is not the gold standard in diagnosing PTSD, it has excellent psychometric properties and diagnostic utility [5–7].

Only two studies have been done on the validity of PTSD diagnoses found in VA administrative data. Although one study did compare different algorithms and included various subgroups, it was potentially limited in its use of self-reported lifetime status of PTSD as its gold standard. The other study included primary care patients only and did not compare different algorithms. Neither of these studies statistically compared the validity of different algorithms. Because both studies found variation in diagnostic validity among subgroups of patients [3–4], we also examined validity within subgroups of interest: age, sex, and clinic where first diagnosed. These results may be particularly helpful to researchers wanting to study PTSD in specific care settings, such as primary care [3,8] or mental health [9]. In addition, high priority areas for the VA in 2009 included studying the needs of female veterans [10] and Operation Iraqi Freedom/Operation Enduring Freedom (OIF/OEF) veterans [11]. Although age is not a direct proxy for service era, it can potentially offer some insight into the validity of PTSD diagnoses from administrative data for this group.

METHODS

Study Design

The first administrative data algorithm (and less restrictive criterion), which involved selecting an individual with at least one PTSD diagnosis in administrative data, was satisfied by all 4,777 veterans in our sample because this was the condition for participating in the national survey study. The second, more restrictive, criterion was used to select individuals among the sample of 4,777 veterans for whom at least two PTSD diagnoses were found in administrative data within a 4-month period of the first diagnosis. This was the only time frame possible given that the study was recruiting patients every 2 weeks; the most recently recruited group had 4 months of data available at the time these analyses were conducted. To check the validity of this time frame, we examined participants who were recruited first for whom we had 6 months worth of follow-up data and found that in 100 percent of cases in which a second diagnosis had been assigned, this diagnosis was given within 2 months of the first one. Therefore, this 4-month window appears to be adequate to determine rates of subsequent PTSD diagnoses. The 4-month window was used for all participants.

Study Sample

This study includes only veterans who had at least one new PTSD diagnosis (ICD-9 code 309.81) in VA administrative data between January 14, 2008, and January 24, 2008 (pilot study) or between May 12, 2008, and January 22, 2009 (main study). Together, there were approximately 30 weeks of total recruitment. Every 2 weeks an average of 1,822 individuals were identified; thus, a total of 27,330 patients were found to be eligible based on the study inclusion/exclusion criteria. Of the people identified every 2 weeks, an average of 571 people were sampled or invited to participate in the survey; the total number of invitations sent was 8,562. Of those, 6 people were deceased and 599 surveys were undeliverable, leaving 7,957 people who received a survey. Questionnaires were sent to each of these veterans, of which 5,207 (65%) completed and returned them. Of our responders, 4,777 (92%) completed all 17 items of the PCL. Our analyses were therefore based on survey and administrative data for these 4,777 veterans.

Data Sources

Administrative Data

The ou tpatient encoun ter data from the NPCD was used for sample selection as well as to search for a second PTSD diagno sis co de within 4 months of the first. Add i-tionally, clinic type, sex, and age were also taken from this administrative data so urce. All de mographic va riables used for responder-nonresponder analysis were taken from administrative data; they incl ude race/ethnicity, sex, mari-tal s tatus, a ge, OI F/OEF s tatus, s ervice c onnection for PTSD status, general service connection status, and census region. All administrative v ariables were extracted at the time that the patient was determined eligible for the study. Clinic type where first diagno sed was derived from stop code in formation and was categorized into three cat ego-ries: primary care, non-P TSD mental health clinic, and PTSD clinics. New P TSD diagnoses made in other clinics were excluded from this study . Age was categorized into three categories: <45, 45–64, and ≥65.

Survey Data

PCL sco res and education level were taken from the survey. Additionally, marital status and race/ethnicity were taken from the survey and supplemented with admin istra-tive da ta where mi ssing. Multiple mai lings were used in accordance with Dillman's methods [12].

PCL

The PCL is a self-r eport questionnaire consisting of 17 Diagnostic and Statistical Manual of Mental Disorders (DSM)-Fourth Edition P TSD symptoms. They are rated on a five-point scale ranging from "not at all" to "extremely." Items are added to obtain a total score. The higher the sc ore, the more   symptoms are prese nt. The PCL is u seful in a variety of screening and clinical con-texts, especially when admini stration of a structured interview is not feasible. It can be us ed as a continuous measure of PTSD symptoms or it can be used to derive a PTSD diagnosis [13–14]. A cu toff score of 50 was used for this analysis to i ndicate PTSD status be cause it is the most commonly used cut-of f score i n military and vet-eran populations [15] and because it h as been sh own to be a good indica tor of PTSD status when compared with both the CAPS [13] and the Structured Clinical Interview for DSM (SCID) [14], which are two gold standards for diagnosing PTSD in the field.

Statistical Analysis

To measure the validity of   PTSD administrative data algorithms, we ca lculated the proportion of veterans with PCL scores of ≥50 for those who had at least one diagnosis and for those who h ad at leas t two for the entire sample and by su bgroups of interest: age, sex, and clinic where first diagnosed with PTSD. These proportions are also the PPVs of having a PCL score o f ≥50. We were un able to calculate negative predictive va lues, sensitivity, and speci-ficity because all of the people in the sample ha d at le ast one PTSD diagnosis in VA administrative data.

Traditional statistical   methods are not appropriat e when comparing the PPV for at least one PTSD diagnosis with the PPV of at least two PTSD diagnoses because the latter are a subset of the forme r, crea ting data depen -dency. Therefore, in order to compare these data, we used bootstrapping methods to asse ss the   statistical signifi -cance of the dif ference betw een th e two PPVs [1 6–18]. We also boots trapped the es timated de crease in sa mple size that resulted from using the more re   strictive algo-rithm (at lea st two diagnoses)   as opposed to the les s restrictive algorithm (at least one diagnosis). We did this for the entire sample and for all subgroups of interest.

Finally, we u sed bootstrapping to determine whether sex, age, or clinic where first diagnosed separately modi-fied the effect of the number of a dministrative diagnoses on the PPVs. For sex, for example, we took the ratio of the PPV for at least two diagnoses and divided it by the PPV for at least one diagnosi s. We then c ompared the ratio for females to the ratio fo r males u sing bootstrap-ping tech niques. Similar tech niques are des cribed by Cole [19]. If the confidence interval (CI) for these ratios of ratios did not include one, then a significant moderat -ing effect was present; in other words, the e ffect of num-ber of dia gnoses on the PPV for PC L scores of ≥50 was significantly different between the groups for the variable in question. We used SAS version 9.1 (SAS Institute, Inc; Cary, North Carolina) for all analyses. For all bo otstrap resampling, we took 2,000 resamples, each of size 4,777, that were randomly selec ted with replacement from the original sample. For all anal yses, the statistic al signifi -cance was defined as 0.05.

To determine whether   nonresponse bias affected the results, we a lso calculated all PPV s a fter a djusting for potential nonresponse bias (results n ot shown). Responder-nonresponder analysis compared those who answered all of the PCL questio ns with those who   did not. T o adju st fo r potential nonresponse bias, we used propensity scores. Spe-cifically, we constructed response propensities and produced

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a weighted combination o f with in-propensity class esti - mates [20]. All vari ables that we had for both respo nders and nonresponders were used. The responders who had one or more missing items on the PCL were a very small group; they were 5 percent of all pa rticipants. As a comparison, nonresponders were 35 percen t o f all p articipants and responders who had no miss ing items on the PCL were 60 percent of all participants. Therefore, it is re asonable to assume that adjusting for nonresponse on the PCL specifi-cally using mult iple i mputation would make little dif fer-ence in the validity of our results.

RESULTS

Responder-Nonresponder

Responders an d no nresponders d iffered o n marital status (55% of responders were married vs 47% of nonre-sponders), OIF/OEF status (27% of responders were OIF/OEF vs 4 0% of n onresponders), and age (36% o f responders were <45 vs 50% of nonresponders). Of note, responders and nonresponders were not different in terms of having a secon d PTSD diagnosis found in administra-tive data after the initial, new diagnosis (60% of respond-ers v s 5 8% of no nresponders). Mo st o f the dif ferences between the adjusted and unadjusted (obse rved) PPVs were 1 pe rcentage po int, and the la rgest dif ference w as 3 percentage po ints. The res ults were not appreciably altered by adjustment; theref ore, th e nonadjusted results are shown.

Main Results

Demographic chara cteristics for at le ast one a nd at least tw o PTSD diagnoses in a dministrative data are shown in **Table 1**. Of particular interest is the distribution of PCL scores for at le ast one ve rsus at lea st two PTSD diagnoses. More veterans are in the higher ranges for at least two diagnoses. As can be se en in **Table 2**, for both the entire sample and for all subgroups, using at least two diagnoses instead of a t least one increas ed the PPV of PCL scores of ≥50 and decreased the available sample size. Notice also that when using at least one diagnosis as the selecti on criterion, 75 pe rcent of the overall sample will have PCL scores of ≥50, with those first diagnosed in p rimary care havin g a lower PPV (69%) and those aged 65 an d o lder havin g an even lo wer PPV (6 1%). Those first diagnosed in non-PTSD mental he alth clinics have the highest PPV (80%).

Table 1.

Demographic c haracteristics fo r thos e wit h ≥1 and ≥2 posttraumatic stress d isorder (PTSD) diagnoses in Department of Veterans Affairs administrative data. Data presented as percent.

Characteristic	≥1 PTSD Diagnosis (*n* = 4,777)	≥2 PTSD Diagnoses (*n* = 2,866)
Male	85	83
Some College or More	69	69
Marital Status		
Married	61	61
Separated/Divorced	21	22
Single	13	14
Widowed	3	2
Race/Ethnicity		
Caucasian	42	42
African American	17	19
Asian/Pacific Islander	5	5
Native American/Native Alaskan	5	4
Latino/Hispanic	18	18
>One Race	13	13
Age (yr)		
<45	36	41
45–64	52	50
≥65	12	9
Clinic Where First Diagnosed with PTSD		
Primary Care	44	32
Non-PTSD Mental Health Clinic	44	54
PTSD Clinic	11	14
PTSD Checklist Score		
<30	4	2
30–39	7	4
40–49	13	12
50–59	22	22
60–69	28	31
≥70	25	29

As can be seen in **Table 3**, all of the increases in PPV values that were found when at least two PTSD diagnoses in VA administrative data as opposed to at least one were used were statistically signifi cant for the entire sample and for all subgroups. The largest increases in PPV were for those ≥65 and those diagnosed in primary care clinics. Not surprisingly, using at least two P TSD dia gnoses as opposed to at leas t one also significantly decrea sed the sample sizes, with the largest decreases in those veterans ≥65 and those first diagnosed in a primary care clinic.

Table 2.
Positive predictive values (PPVs) for ≥1 and ≥2 posttraumatic stress disorder (P TSD) diagnoses in De partment o f V eterans Affairs administrative data for PTSD Checklist scores of ≥50.

Variable	≥1 PTSD Diagnosis	≥2 PTSD Diagnoses
All		
Total *n*	4,777	2,866
PPV	74.8	81.8
Female		
Total *n*	731	487
PPV	72.6	80.3
Male		
Total *n*	4,046	2,379
PPV	75.2	82.1
Age <45		
Total *n*	1,724	1,186
PPV	75.2	81.2
Age 45–64		
Total *n*	2,478	1,421
PPV	77.7	83.4
Age ≥65		
Total *n*	575	259
PPV	61.4	76.1
Primary Care Clinic		
Total *n*	2,071	914
PPV	69.3	78.7
Non-PTSD Mental Health Clinic		
Total *n*	2,122	1,537
PPV	79.9	84.1
PTSD Clinic		
Total *n*	540	399
PPV	77.6	81.0

Finally, as ca n be seen in **Table 4** , the difference in the ratio of PPV ratios betw een males and females was not significant, whereas clini c where first d iagnosed and age did show significant dif ferences in PPV ratios. The effect of the number of P TSD diagn oses on the PPV of PCL scores of ≥50 across age groups was significant only when comparing the group of older veterans with the two younger age groups. A lso, a significantly greater ef fect was noted for at least two diagnoses as opposed to at least one on the PPV for people first diagnosed in primary care as opposed to mental health or PTSD clinics.

Of note, the estimates of the dif ferences in PPVs, decreases in sample size (**Table 3**), and the ratios of ratios (**Table 4**) are unbias ed because the mea n of the bootstrapped distributions are within 1 to 3 percent of the observed values [18].

We can also be assured that our 95 percent CIs are accurate for two reasons. W e followed the suggestio n of Efron and Tibshirani in doing at least 1,00 0 bootstrapped samples to get accurate CIs [17], and the bootstrapped dis-tributions of the sampling distributions of the PPV differ-ences, the s ample size differences, and the ra tios of ra tios were symme trical in shape. The more ske wed the s am-pling distribution, the less likely that the 2.5 and 97.5 per-centiles o f th e bootstrap sampling distrib utions reflect a true 95 percent CI.

DISCUSSION

In summary, we found si gnificantly greater validity associated with using the more restrictive selec tion crite-rion (at leas t two P TSD diagnoses) than the le ss restric-tive criterion (at least one diagnosis). Using at least two diagnoses instead of at least one also had the effect of significantly reduc ing the av ailable sample size, with an overall re duction of 40 percen t. This result persisted by subgroups, and significa nt moderating ef fects we re also found.

Our data are consistent with those of F rayne et al. who also found a higher PPV when using at least two as opposed to at least on e administrative PTSD diagnoses [4]. A contrasting result is that we fou nd a PPV of 75 percent and Frayne et al. found a PPV of 82 percent for any outpatient visit. In addition, we found that the PPV of primary care visits was lower than the PPV for mental health care visits (69% vs 80%), wh ereas Frayne et al. found the opposite (88% vs 85%) when using at least one diagnosis as the criterion; however, both studies suggest a variation by clinic type. Dif ferences are possibly due to study design, particularly our dependent variables and the time frame used to search for PTSD diagnoses in adminis-trative data. Our study is potentially more accurate because we we re us ing conte mporaneous measures of PTSD dia gnosis an d PCL s core, w hereas Fray ne et al. used lifetime self-reported PTSD diagnosis as their depen-dent variable. Additionally, our difference was larger and statistically significant.

Although Magruder and Y eager us ed a dra stically different study design [3], some c omparisons can be made. Their s tudy gave e vidence that PTSD diagnoses are under-recognized in primary care. Our study suggests

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Table 3.

Bootstrapped sta tistical c omparisons bet ween ≥1 and ≥2 posttraumatic stress disorder (P TSD) dia gnoses in Department of Veterans Af fairs administrative data.

Characteristic	PPV Difference: ≥1 vs ≥2 PTSD Diagnoses	95% CI	% Decrease in Sample Size from ≥1 to ≥2	95% CI
All	7.0	6.0–8.0	40.0	38.7–41.5
Female	7.6	5.1–10.3	33.4	29.9–36.9
Male	6.9	5.7–8.0	41.2	39.7–42.8
Age <45	6.0	4.6–7.5	31.2	29.0–33.4
Age 45–64	5.7	4.2–7.1	42.7	40.8–44.6
Age ≥65	14.6	10.5–19.0	54.9	50.7–58.7
Primary Care Clinic	9.4	7.2–11.6	55.9	53.8–58.0
Non-PTSD Mental Health Clinic	4.2	3.0–5.3	27.6	25.6–29.6
PTSD Clinic	3.3	1.0–5.7	26.1	22.4–30.0

CI = confidence interval, PPV = positive predictive value.

Table 4.

Ratios of positive predictive value (PPV) ratios for designated subgroups with 95% confidence intervals (CIs) computed via bootstrap resampling.

Characteristic	Ratio of PPV Ratios	95% CI
Sex		
Male vs Female	1.01	0.98–1.05
Age Group		
<45 vs 45–64	1.01	0.98–1.03
<45 vs ≥65	0.87	0.82–0.93
45–64 vs ≥65	0.87	0.81–0.92
Clinic Where First Diagnosed with PTSD		
PTDS Clinic vs Non-PTSD Mental Health	0.99	0.96–1.02
PTSD Clinic vs Primary Care	0.92	0.88–0.96
Non-PTSD Mental Health vs Primary Care	0.93	0.90–0.96

Note: CIs not inc luding value 1 indicate that effect of number of PTSD diag- noses (≥1 vs ≥2) on PPV for PTSD Checklist scores of ≥50 is significantly dif- ferent between two subgroups (i.e., evidence of interaction).
PTSD = posttraumatic stress disorder.

that PTSD is potentially over-diagnosed in primary care compared with other settings because based on our com- parison with PC L scores , ma ny of the initia l diagnoses are likely to be in error . Magruder and Yeager looked at subgroups and, similar to our study, found no significant differences in pro vider recognition of PTSD (find ing at least one PTSD diagnosis in administrative data) base d on sex, but did find a difference based on age, suggesting possible differences in clinical severity or presentation by age cohort.

Limitations

There are several limitations to this administrative data analysis. One limitation was that it is a secondary analysis of a lar ger study. Since th e PCL was only g iven to those people who were identified in VA ad ministrative d ata as having at least one PTSD diagnosis, we were unable to cal- culate sensiti vity, specificity, or negative predictive value. However, we were ab le to look at the co rrespondence between administrative data and PCL scores by looking at PPVs. The da ta an alyzed were restricted to newly diag - nosed PTSD patients (defined as not hav ing had a P TSD diagnosis in the previo us year); ho wever, if participants were seen outside the VA or if they had another P TSD diagnosis before that year, it is possible that some of these were not new cases. In addition, we only used a 4-month period to look for a second diag nosis. Usin g more th an 4 months or usin g an y alternate time frame could create different results. This study does ho wever provide a lar ge national sample that allows for comparison of administra - tive data with PCL scores across different care settings and types of patients.

A second limitation of this study was that the survey response rate was a verage to low (65%). T o potentially combat this, we examined differences between respond- ers and no nresponders and u sed pro pensity metho ds to adjust for thes e differences whe n estimating the PPVs . The observed PPVs were ve ry similar to the PPVs tha t were adjusted for potential nonresponse bias.

A t hird limitation was that this secondary analysis did not allow for conclusions to be made regarding the reasons for the findings. It is po ssible that veterans who have more se vere c ases of P TSD are preferentially se en

in mental health clinics or that primary care doctors refer more severe cases to mental health clinics. Additionally, older veterans may have milder symptoms or symptoms that diminish over time but may still be considered by a VA clinician as having PTSD. We also do not know how providers decide to enter diagnosis codes into administrative records. One study looked at self-reported behaviors for screening and treating PTSD in the VA [21]. The authors compared PTSD specialists and mental health generalists. They found that generalists screened for PTSD much less consistently than they screened for depression or substance abuse and that PTSD specialists were more likely to use validated assessment measures. However, that study was conducted before the implementation of any type of universal PTSD screening. There is evidence to suggest that as of June 2004, universal PTSD screening has been implemented for OIF/OEF veterans [22] through the 4-item primary care PTSD Screen [23]. However, Seal et al. found that after implementing this directive, only 45 percent of OIF/OEF veterans that presented at VA medical centers postdeployment were screened [24]. It is unclear whether methods exist that would allow for more consistency or accuracy in entering PTSD diagnoses into VA administrative databases.

More research is needed in three areas. First, more studies are needed that compare PTSD diagnoses in VA administrative data with one of the gold standards for diagnosing PTSD: the SCID or the CAPS. Second, various algorithms should be tested on VA administrative data so that researchers can use administrative data and be as accurate as possible when using it. Third, future studies need to include a more complete look at accuracy, including sensitivity, specificity, PPV, and negative predictive value.

Sample Selection Recommendations

To select a sample of veterans who have a more definitive PTSD diagnosis using administrative data, researchers should select those veterans with at least two PTSD diagnoses as opposed to at least one. This is particularly true for those first diagnosed in primary care and for older veterans. Using at least two diagnoses might be particularly useful in situations in which a researcher wants to examine the effects of an intervention for those with chronic illness or wants a pure sample to test a PTSD medication. Another consideration might be cost. If a researcher is doing expensive face-to-face interviews, it may be important to have more confidence in the PTSD

diagnosis. However, if a researcher is conducting a postal survey, it may not be as expensive to include people with fewer symptoms who may not have PTSD. If doing a study similar to this one, researchers will have to allow for longer recruitment periods to get the sample size needed.

Researchers may also choose to continue to use at least one diagnosis as their criteria. If choosing to do this, 75 percent of the sample will have PCL scores of ≥ 50. This suggests that for 75 percent of the sample, researchers can have a relatively high degree of confidence in the accuracy of the PTSD diagnoses but will be more likely to include some people who probably do not have PTSD. Less confidence can be given to PTSD when it is first diagnosed in primary care and in those ≥ 65. Using at least two diagnoses may not be as important if a researcher is only studying those first diagnosed in non-PTSD mental health or PTSD clinics or veterans under the age of 65. Additionally, researchers might consider using at least one diagnosis if they are doing a study focused on the utility of a new diagnostic tool or on interventions to engage veterans in mental health treatment. In these cases, it might be reasonable to include people with less severe PSTD symptoms. Another consideration is if one is doing a local study as opposed to a national study; in a local study, a severe reduction in sample size may not be practical. Knowledge of the PPV of different sampling algorithms can help researchers know with more accuracy the actual composition of their samples.

CONCLUSIONS

The investigation of the validity of PTSD diagnosis codes found in VA administrative data is essential to using these codes appropriately in VA research. The results of this study indicate that to select a sample of veterans with more definitive PTSD from VA administrative data, researchers should select those veterans with at least two diagnoses as opposed to those with at least one. This is particularly true for those first diagnosed in primary care and for older veterans but statistically significant for the entire sample and all subgroups of interest: age, sex and clinic where first diagnosed. Researchers should also consider the consequences of using one algorithm over the other in terms of the desired homogeneity and sample size. It is important for researchers to know with more accuracy the actual composition of their samples when

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using VA administrativ e data to select samples for P TSD studies so that acc urate infe rences can be made and, ulti-mately, more effective interventions for PTSD can be devel-oped. More research is needed on the v alidity of P TSD diagnoses found in VA administrative data.

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